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ENERGY DIVISION

# DATA PACKAGE FOR THE ATOMIC VAPOR LASER ISOTOPE SEPARATION (AVLIS) PLANT ENVIRONMENTAL IMPACT STATEMENT

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## 1.3 ENRICHMENT TECHNOLOGIES

In its natural state, uranium (U) is composed of about 0.7% $^{235}U$ and about 99.3% $^{238}U$. For use as the fissionable isotope in nuclear fuel, it must be enriched in order to obtain a greater percentage of $^{235}U$. The AVLIS process will be designed to enrich the uranium to less than 5% $^{235}U$.

The only commercial production method currently used for enriching the $^{235}U$ isotope is the gaseous diffusion process. The basis of the process is the molecular diffusion of uranium hexafluoride gas ($UF_6$), which is both the feed material to the diffusion process and the enriched product used in nuclear fuel fabrication. The gaseous diffusion process separates $^{235}U$ from $^{238}U$ by difference in isotopic mass. $UF_6$ feed material is prepared from uranium ore concentrate, and the enriched $UF_6$ gaseous product is processed to nuclear fuel uranium dioxide ($UO_2$) by fuel fabricators under contract to utility companies.

In contrast, the AVLIS process separates the atoms of $^{235}U$ from $^{238}U$ by electrostatic extraction of laser-produced $^{235}U$ ions. In the first step, metallic uranium is melted and vaporized (Fig. 1.3-1). The vapor is then illuminated by precisely tuned laser light that can be absorbed by $^{235}U$ atoms. The absorption of this energy causes individual $^{235}U$ atoms to emit an electron. The loss of an electron from the $^{235}U$ atom creates a charged $^{235}U$ ion. The $^{238}U$ atoms, which are unaffected by the laser beams, pass through the product collector to condense on the tails collector. The enriched uranium liquid metal condensate flows out of the separator to the cast and is stored in solid metallic form for eventual conversion to uranium oxide for reactor fuel rods.

## 1.4 PROJECT DESCRIPTION OF THE AVLIS PRODUCTION PLANT

Current DOE long-range plans are to begin construction of the AVLIS plant in March 1993 and to complete the plant in December 1997. The capacity of the enrichment facility is currently designed to be 10 million separative work units (SWU). This compares with about 11 million and 8 million SWU capacity at PGDP and PORTS respectively. Initial plans call for the AVLIS production plant to operate concurrently with the two gaseous diffusion plants.

The total construction cost of the AVLIS facility in 1994 dollars is expected to be about $1 billion. The peak demand for construction workers would occur during the third year of construction at each site, with a maximum of more than 1500 construction workers. The peak production workforce would be about 1300 individuals.

The conceptual design of the AVLIS facility requires approximately 80 acres of land to site. Plans for each of the three enrichment facility AVLIS production plants integrate existing enrichment facilities and utilities into preliminary designs. Preliminary plans call for ORGDP to construct a stand-alone AVLIS facility (Fig. 1.4-1, in a plastic sleeve after Appendix I). PGDP preliminary plans entail constructing a stand-alone facility or integrating part of the new AVLIS facility into existing Building C-333. Figure 1.4-2, in a plastic sleeve after Appendix I, shows the location of the stand-alone option at PGDP and the location of Building C-333. PORTS preliminary plans call for the use of buildings completed for the Gas Centrifuge Program. The primary buildings at PORTS considered for the AVLIS facility are X-3001, X-3002, and X-7725 (Fig. 1.4-3, also in a plastic sleeve after Appendix I). AVLIS Production Plant plans for all three enrichment sites are in initial conceptual stages and may change as more detailed assessments are completed.

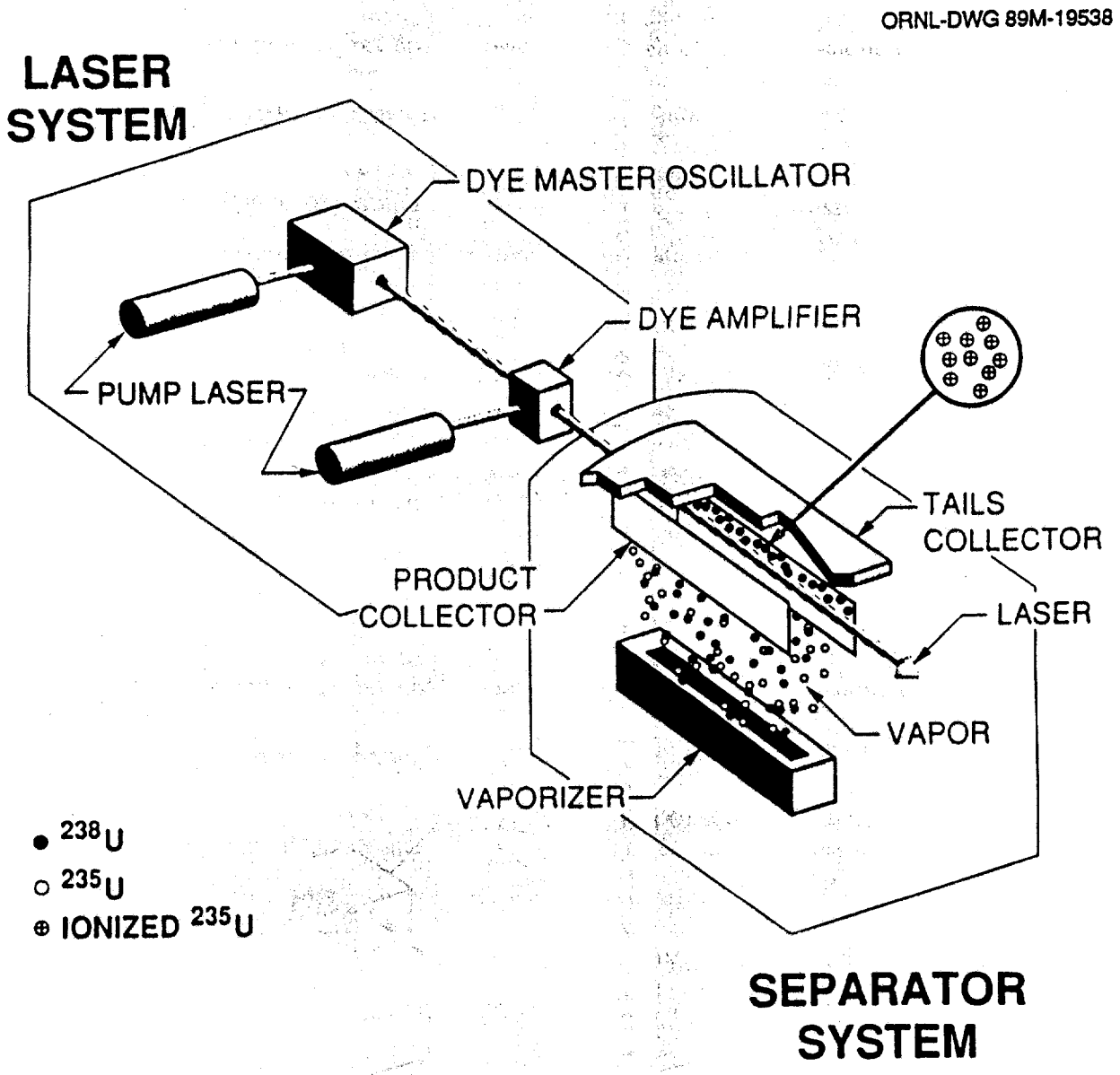


Fig. 1.3-1. The Atomic Vapor Laser Isotope Separation (AVLIS) process.